



EFFECT OF FLUORIDATED DENTIFRICES ON STREPTOCOCCUS MUTANS AND LACTOBACILLUS ACIDOPHILUS – AN IN-VITRO STUDY

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ABSTRACT

Introduction: Dentifrices have widely been used for the delivery of oral therapeutic ingredients such as fluorides. Tooth-cleaning with a dentifrice involves a number of factors which could influence efficacy, one of which could be amount of fluoride in the dentifrice. However, there are not many studies to demonstrate the effect of different concentrations of fluoride in dentifrices on caries causing organisms like *Streptococcus mutans* and *Lactobacillus acidophilus*.

Aim: To compare the antimicrobial effectiveness of two dentifrices with different fluoride concentrations on *Streptococcus mutans* and *Lactobacillus acidophilus*.

Method: Pure strains of *Streptococcus mutans* and *Lactobacillus acidophilus* were inoculated in MRS broth tubes at 37°C for 48 hours. An amount of 0.5g of 1000 ppm regular toothpaste and 5000 ppm fluoridated toothpaste was made to 2ml with sterile saline. The tubes were spun at 2500rpm for 10min. The upper layer was then taken and centrifuged again at 3500 rpm for 10min. The supernatant thus obtained was used to assess its effect on *Streptococcus mutans* and *Lactobacillus acidophilus*. In 40 ml of MRS broth, 1ml each of the inoculum was taken. Around 1.75ml of this inoculated suspension was dispensed into test tubes to which each of the prepared samples was added. The growth was observed after 48 hours.

Result: The inhibitory effect of 5000 ppm fluoride dentifrice on *Streptococcus mutans* is significantly better than that of regular toothpaste while regular toothpaste on *Lactobacillus acidophilus* is significantly better than that of 5000 ppm fluoride toothpaste.

Conclusion: The present study concludes that the 5000 ppm fluoride dentifrice exhibited highest antimicrobial effectiveness on *Streptococcus mutans*. Regular dentifrice exhibited highest antimicrobial effectiveness on *Lactobacillus acidophilus*.

KEYWORDS: S. mutans, L. acidophilus, 5000 ppm fluoride dentifrice, 1000 ppm regular dentifrice

INTRODUCTION

Toothbrushing has been an accepted means of tooth cleaning for much of this century. For many years, dentifrices have also been used as vehicles for the delivery of oral therapeutic ingredients such as fluorides and anti-plaque agents (Duckworth et al, 1991). The large decline in caries prevalence in the world over the past 15-20 years has been attributed to the widespread home use of fluoride products, especially dentifrices (Zero, 1988; Murray and Rugg-Gunn, 1991; Marthaler, 1984; Renson et al, 1985). Fluoride dentifrices have thus been well accepted for their caries preventive effects (Paul et al, 1993).

Tooth cleaning with a dentifrice involves a number of factors which could potentially influence efficacy. One of these potential factors could be the amount of fluoride present in the dentifrice used. It is a known fact, since time immemorial that *Streptococcus mutans* and *Lactobacillus acidophilus* are two of the primary causative agents for dental decay. However, there are not many studies to demonstrate the effect of different concentrations of fluoride in dentifrices on caries causing microorganisms.

AIM

To determine the in vitro effect of two dentifrices with different fluoride concentrations on *Streptococcus mutans* and *Lactobacillus acidophilus*.

MATERIALS AND METHODS

Preparation of the inoculum:

The primary strains used in the study were *Streptococcus mutans* and *Lactobacillus acidophilus*. The strains were obtained from IMTECH, Chandigarh. MRS agar was obtained from HiMedia, Manipal. This MRS agar was used to prepare MRS agar slants in which *Streptococcus mutans* and *Lactobacillus acidophilus* were grown for 72 hours.

Loopful of *Streptococcus mutans* and *Lactobacillus acidophilus* growth from MRS agar slants was inoculated into a tube containing 2ml of MRS broth. They were then incubated at 37°C in a desiccator for 48 hours. The culture thus obtained of both microorganisms was used as inoculum for the study.

Preparation of samples:

Approximately 0.5g of both the 1000 ppm regular toothpaste and the 5000 ppm fluoridated toothpaste was taken into sterile microfuge tubes and made to 2ml with sterile saline. The tubes were spun at 2500rpm for 10min. The upper layer was further taken in centrifuge tubes and centrifuged again at 3500 rpm for

10min. The supernatant thus obtained was used to study the effect on the growth of *Streptococcus* and *Lactobacillus* species.

Study of antimicrobial effect:

In 40 ml of MRS broth, 1ml of the inoculum containing *Streptococcus mutans* and *Lactobacillus acidophilus* was taken. 1.75ml of this inoculated suspension was dispensed into test tubes to which each of the samples were added. The growth was observed after 48 hours and the absorbance was read at 660 nm.

STATISTICAL ANALYSIS

Data was entered and analyzed using SPSS Version 16.0 (Chicago, SPSS Inc). Independent-t test was used to compare the mean inhibition of 1000 ppm and 5000 ppm dentifrice on *Streptococcus mutans* and *Lactobacillus acidophilus*. The level of significance was set at 0.05.

RESULTS AND DISCUSSION

Table 1: Mean Percentage Inhibition of *Streptococcus mutans*

Groups	No. of samples	Mean Inhibition (%)	Standard Deviation	P value
1000 ppm (Regular)	5	46.98	1.03	0.000
5000 ppm (Fluoride)	5	53.09	1.23	

Table 2: Mean Percentage Inhibition of *Lactobacillus acidophilus*

Groups	No. of samples	Mean Inhibition (%)	Standard Deviation	P value
1000 ppm (Regular)	5	42.42	0.87	0.000
5000 ppm (Fluoride)	5	13.34	0.63	

The inhibitory effect of 5000 ppm fluoride dentifrice on *Streptococcus mutans* was found to be 53.09% whereas that of regular toothpaste was 46.98% and the difference was found to be statistically significant (Table-1). The inhibitory effect of regular toothpaste on *Lactobacillus acidophilus* was 42.42%, which was significantly higher in comparison to that of 5000 ppm fluoridated toothpaste which was found to be 13.34% (Table-2).

Dental Caries is one of the most widespread disorders of the world. The World Health Organisation estimates that 60-90% of schoolchildren around the world suffer from dental caries. It has been demonstrated, time and again, that dental caries progression occurs due to a major role played by opportunistic organisms like *Streptococcus mutans* and *Lactobacillus acidophilus*. The relationship between these causative organisms and the initiation and proliferation of dental caries remains unclear, although many researches have pointed out that *Streptococcus mutans* proliferation leads to acid production, which promotes tooth decay (Saha et al, 2007). According to the present study, 5000 ppm fluoride toothpaste had a better effect on *Streptococcus mutans* as compared to 1000 ppm regular dentifrice. Better antimicrobial effectiveness of 5000 ppm fluoride dentifrice could be because of the higher concentration of fluoride present in it.

The appearance of *Lactobacilli* in the oral cavity occurs very early in a child's life – around the first year. Over the last few decades, many researches have pointed out a significant correlation between salivary *Lactobacillus* count and dental caries. It was seen that, wherever the DMF index was high, the *Lactobacillus* count was also high. In fact, historically, *Lactobacilli* were the first microorganisms implicated in dental caries development (Badet and Thebaud, 2008). According to the present study, 1000 ppm regular toothpaste had a better effect on *Lactobacillus acidophilus* as compared to 5000 ppm fluoridated dentifrice. In a review by Cochrane Oral Health Group, a 5% reduction in tooth decay is seen in those toothpastes containing triclosan and fluoride as compared to those containing fluoride alone (Health Behaviour News Service, 2014). The 1000 ppm regular toothpaste used in the current study contained triclosan whereas the 5000 ppm fluoridated toothpaste did not. This could be the reason why antimicrobial effectiveness of 1000 ppm regular dentifrice against *Lactobacillus acidophilus* was better than 5000 ppm fluoridated toothpaste.

Ever since the discovery of fluoride as anti-cariogenic, there has been increased research on what is the optimum concentration of fluoride for caries inhibition. However there is a lack of studies done on the direct effect of fluoridated dentifrices, on caries-causing microorganisms like *Streptococcus mutans* and *Lactobacillus acidophilus*. Further studies, both in-vitro and in-vivo are highly recommended.

CONCLUSION

The present study concludes that the 5000 ppm fluoride dentifrice exhibited highest antimicrobial effectiveness on *Streptococcus mutans*. 1000 ppm regular dentifrice exhibited highest antimicrobial effectiveness on *Lactobacillus acidophilus*.

REFERENCES:

1. Duckworth RM, Knoop DTM, Stephen W. (1991). Effect of Mouthrinsing after Toothbrushing with a Fluoride Dentifrice on Human Salivary Fluoride Levels. *Caries Research*, 25, p. 287-291.
2. Zero DT, Fu J, Espeland MA, Featherstone JDB. (1988). Comparison of Fluoride Concentrations in Unstimulated Whole Saliva following the use of a Fluoride Dentifrice and a Fluoride Rinse. *Journal of Dental Research*, 67, p. 1257-1262.
3. Murray JJ, Rugg-Gunn AJ. (1991). Fluoride in Caries Prevention. Bristol wright 1982. Quoted in *Caries Research*, 25, p. 287-291.
4. Marthaler TM. (1984). Explanations for Changing Patterns of Disease in the Western World. *Cariology Today*, p. 13-23.
5. Renson CE et al. (1985). Changing Patterns of Oral Health and Implications for Oral Health Manpower. *International Dental Journal*, 35, p. 235-251.
6. Paul S, Tandon S, Murthy K. (1993). Effect of Fluoride Dentifrices on Salivary Fluoride Levels in Children. *Indian Journal of Dental Research*, 4, p. 95-101.
7. Saha S, Tomaro-Duchesneau C, Malhotra M, Tabrizian M, Prakash S (2012) Suppression of *Streptococcus mutans* and *Candida albicans* by Probiotics: an In vitro Study. *Dentistry*, 2, p. 141. doi:10.4172/2161-1122.1000141.
8. Badet C, Thebaud N. (2008). Ecology of *Lactobacilli* in the Oral Cavity: A Review of Literature. *Open Microbiol J.*, 2, p. 38-48.
9. Health Behavior News Service, part of the Center for Advancing Health. (2014, January 9). Antibacterial agent boosts toothpaste effectiveness. *ScienceDaily*. Retrieved February 14, 2017 from www.sciencedaily.com/releases/2014/01/140109175500.htm